EPA

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THE HEALTH OF STREAMS IN THE CAMPASPE, LODDON AND AVOCA CATCHMENTS

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Introduction

Careful management of our waterways and catchments is crucial to maintain and improve river health. Good decision making requires detailed information on the environmental condition of our rivers.

The Monitoring River Health Initiative (MRHI) – a biological monitoring program across Australia – was introduced as part of the National River Health Program funded by the Commonwealth. The main aim of the MRHI was to develop a standardised biological assessment scheme for evaluating river health. This was to be achieved by sampling reference sites and using the information collected to build models to predict which macroinvertebrate families would be expected to occur under specified environmental conditions. In Victoria the program was conducted by the Environment Protection Authority (EPA) and AWT Victoria (formerly Water EcoScience). In urban areas, this is also complemented by Melbourne Water's Healthy Waterways program.

Currently, an Australia-wide Assessment of River Health (AWARH) is being conducted under the National Rivercare Program to assess the health of Australia's rivers. EPA is sampling approximately 600 test sites in Victoria and evaluating these against the MRHI models.

Having undertaken biological monitoring in Victoria since 1983, EPA has a great deal of experience in the field. The results of previous studies will be combined with those of the current program, providing a solid background of data. This will be used to determine long term trends in the health of our rivers and will help the protection of water quality and the beneficial uses of our water courses.

Monitoring water quality

Traditional water quality monitoring involves measuring physical and chemical aspects of the water. Common measurements include pH, salinity, turbidity, nutrient levels, toxic substances and the amount of oxygen dissolved in the water. These measures provide a 'snapshot' of environmental conditions at the moment samples are taken. Water quality conditions are variable, so such monitoring can fail to detect occasional changes or intermittent pulses of pollution.

In contrast, the biological monitoring program involves sampling aquatic animals, which gives an indication of the health of the river as a whole. Because they live at the site for some time, animals reflect the build-up of impacts of environmental change on the river ecosystem – such as the influence of surrounding land use or the effects of pollution.

A combination of analytical and interpretative measures gives far more reliable results than any measure on its own.

Number of families

The number of invertebrate families found in streams can give a reasonable representation of the health of a stream, though it is too great a simplification of data to be adequate on its own. Lack of suitable habitat or the presence of various pollutants can cause a reduction in the number of families present. This assessment method complements SIGNAL (see below) which tends to underestimate toxic effects.

SIGNAL

This biotic index uses families of aquatic invertebrates that have been awarded sensitivity scores according to their tolerance or intolerance to various pollutants. The index is calculated by totalling these scores and dividing by the number of families present. A single value between one and 10 is produced, reflecting the degree of water pollution – high quality sites have high SIGNAL scores (Chessman 1995) (table 1). While SIGNAL is particularly good for assessing water quality problems such as salinisation and organic pollution, its usefulness for toxic impacts and other types of disturbance is uncertain.

Table 1: Key to SIGNAL scores

SIGNAL score	Water quality
>7	Excellent
6-7	Clean water
5-6	Doubtful, mild pollution
4-5	Moderate pollution
<4	Severe pollution

AUSRIVAS

One of the main aims of the National River Health Program was the development of predictive models which could be used to assess river health. As a result, the Co-operative Research Centre for Freshwater Ecology has developed the Australian Rivers Assessment System (AUSRIVAS) which consists of several mathematical models. These models are being refined in 2000.

Each model uses reference data collected under the MRHI from a single aquatic habitat from either a single season (autumn or spring) or from the two seasons combined (Coysh *et al.* 2000).

AUSRIVAS predicts the macroinvertebrates which should be present in specific stream habitats under reference conditions. It does this by comparing a test site with a group of reference sites which are as free as possible of environmental impacts but have similar physical and chemical characteristics to those found at the test site.

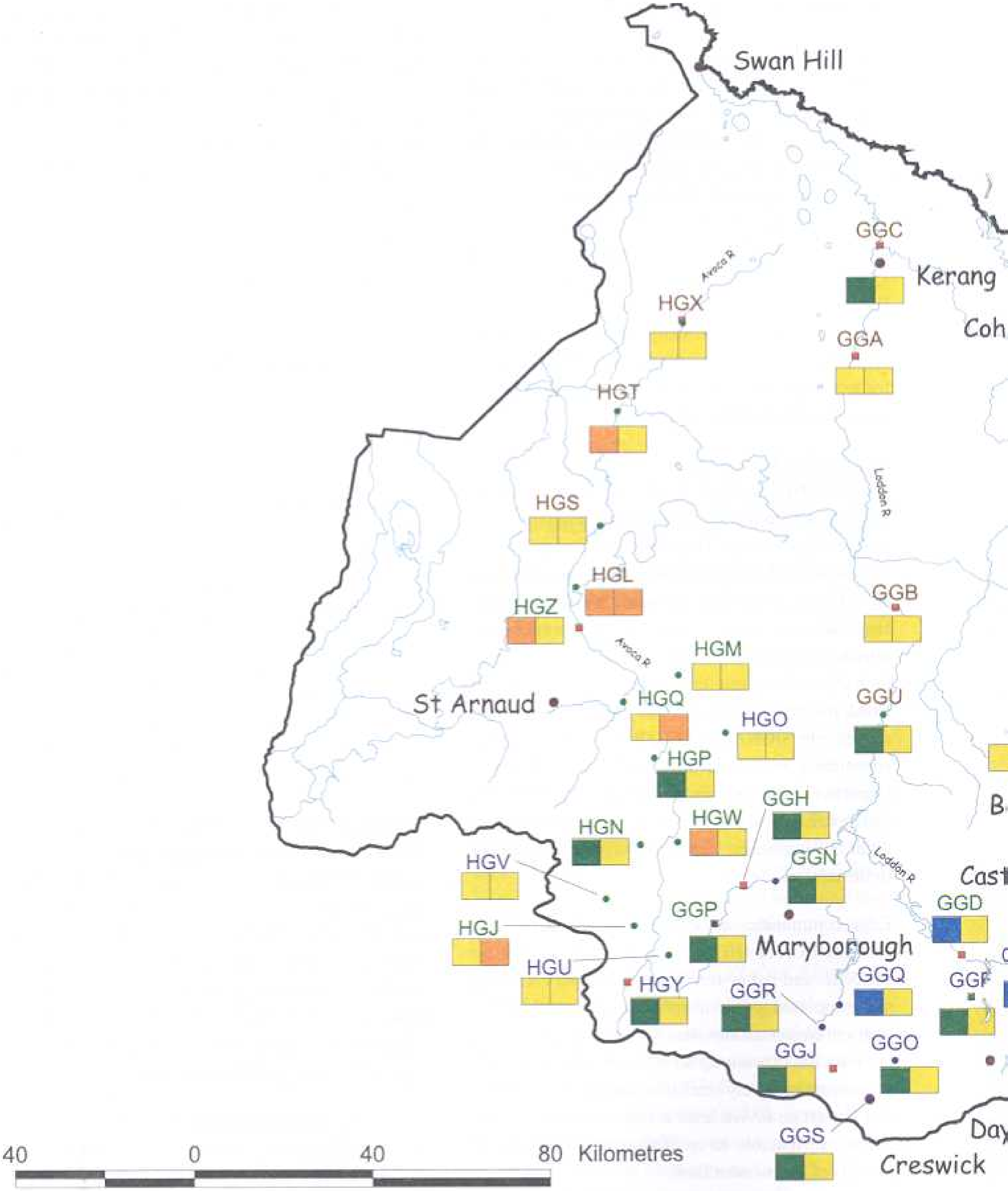
One of the products of AUSRIVAS is a list of the aquatic macroinvertebrate families and the probability of each family being found at a test site if there were no environmental impacts. By comparing the totalled probabilities of predicted families and the number of families actually found, a ratio can be calculated for each test site. This ratio is expressed as the observed number of families/expected number of families (the O/E index).

The value of the O/E index can range from a minimum of zero (none of the expected families were found at the site) to around one (all of the families which were expected were found). It is also possible to derive a score of greater than one, if more families were found at the site than were predicted by the model. A site with a score greater than one might be an unexpectedly diverse location, or the score may indicate mild nutrient enrichment by organic pollution, allowing additional macroinvertebrates to colonise.

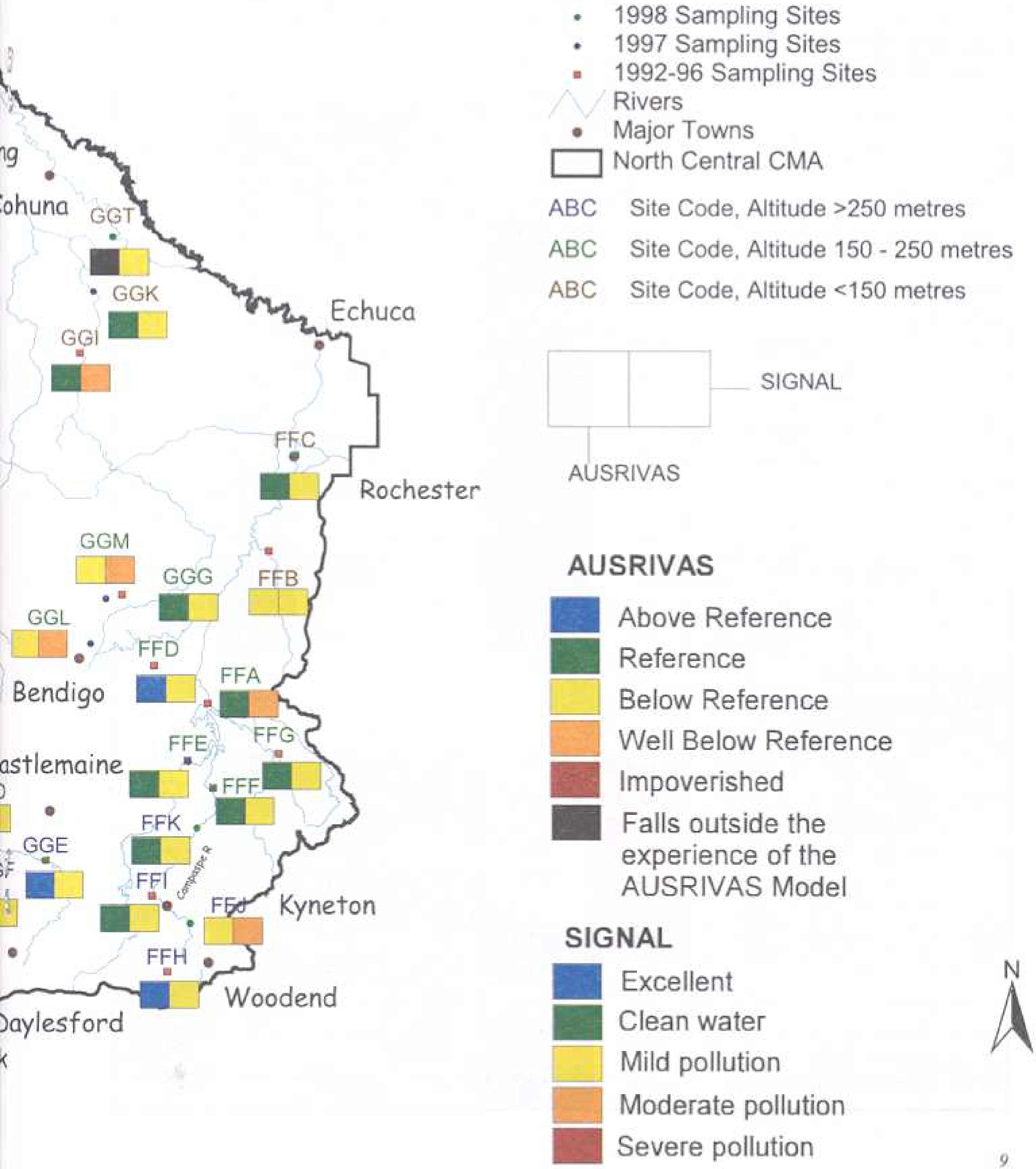
The O/E scores derived from the model can then be compared to bands representing different levels of biological condition, as recommended under the MRHI (table 2). This allows an assessment of the level of impact on the site to be made and characterisation of the general health of the part of the river that was sampled.

At this stage of its development, it appears that AUSRIVAS is more sensitive to changes in habitat than to changes in water quality.

Figure 1: AUSRIVAS O/E and SIGNAL family
for the Campaspe, Avoca a



ly bands (edge habitat, combined seasons)
a and Loddon Catchments



Remedial measures which should be undertaken to reduce nutrient inputs to streams include:

- revegetation of riparian zones and land surfaces which are subject to storm runoff, thereby reducing soil erosion and transport of associated nutrients.
- restriction of stock access to waterways, thus minimising bank erosion and preventing livestock excretory products from entering the stream.
- reduction of nutrient export from urban areas, which can be achieved by reuse of effluent from sewage treatment plants and the upgrade of treatment facilities from secondary to tertiary, and by the passing of stormwater runoff through artificial wetlands to remove nutrients.

The Government's water reform initiative aims to ensure that municipal sewage management is upgraded. All water authorities are currently implementing either major upgrades to their sewage treatment plants to reduce nutrient loads or are implementing new effluent reuse schemes. When completed, these measures should result in an improved level of river health in areas currently affected by nutrient rich discharges.

Salinity management plans for the North Central region have been developed, and implementation has already demonstrated the benefits of these plans (North Central Catchment and Land Protection Board, 1997). A continued commitment to the management plans is essential.

Remedial action to overcome the environmental impacts of flow modifications will be difficult. Available surface water in the three catchments is almost completely allocated for agricultural and domestic use, and redirection of water for environmental flows will have social and economic consequences. Nonetheless, it is essential that water audits be undertaken with a view to increasing river flows and establishing more natural flow regimes downstream of reservoirs.

The development of a catchment management strategy and associated implementation programs for the North Central region represents a very positive step for protection of the environment. It is essential, however, that the success of programs be evaluated. Monitoring of river macroinvertebrate communities is recommended as a measure of future environmental changes.

References

Anon. 1988, *State of the Environment Report 1988. Victoria's Inland Waters*, Office of the Commissioner for the Environment, Melbourne.

Anon. 1998, *State Water Quality Monitoring Annual Report: Victoria 1997*, Water Ecoscience Pty Ltd, Mt Waverley, Victoria.

ANZECC 1992, *Australian Water Quality Guidelines for Fresh and Marine Waters*, Australian and New Zealand Environment and Conservation Council.

Chessman, B.C. 1995, 'Rapid assessment of rivers using macroinvertebrates: A procedure based on habitat-specific sampling, family level identification and a biotic index' *Australian Journal of Ecology*, 20: 122–129.

Coysh, J.L., Nichols, S.J., Norris, R.H., Barmuta, L.A. and Blackman, P. 2000, *Australian River Assessment System (AUSRIVAS) National River Health Program Predictive Model Manual*, Cooperative Research Centre for Freshwater Ecology, Building 15, University of Canberra, ACT, 2601, http://ausrivas.canberra.edu.au/ausrivas

EPA 1995, *Preliminary Nutrient Guidelines for Victorian Inland Streams*, EPA Publication 478, Environment Protection Authority (Vic).

North Central Catchment and Land Protection Board 1997, North Central Regional Catchment Strategy, 71 pp.

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